REMARKS/ARGUMENTS

Claims 3-7, 9-17 and 19-21 are pending in the present application and stand rejected. In response, Claims 3, 5, 7, 11, 12, 16 and 17 are amended, Claims 22-28 are added and Claims 6, 15, 19 and 21 are cancelled. Claims 1, 2, 8 and 18 were previously cancelled. Reconsideration in light of the amendments and remarks made herein is respectfully requested.

Objection to the Specification

The Abstract of the disclosure is objected to for containing the phrase "means for". The Abstract has been amended to remove the phrase "means for" and a Replacement Abstract is attached hereto.

Claims Rejected Under 35 U.S.C. § 102

Claims 3-7, 9, 16, 17, and 19-21 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,634,430 issued to Polaschegg. ("Polalschegg").

Independent Claims 19 and 21 are cancelled as is dependent Claim 6.

Rejection Under 35 U.S.C. § 103

Claims 10, 12 and 13 are rejected under 35 U.S.C. §103(a) as being unpatentable over Polaschegg as applied to Claim 5 in view of U.S. Patent No. 5,902,096 issued to Behringer et al. ("Behringer").

Claim 11 is rejected under 35 U.S.C. §103(a) as being unpatentable over Polaschegg as applied to Claim 6 in view of U.S. Patent No. 3,947,156 issued to Becker.

Claim 14 is rejected under 35 U.S.C. §103(a) as being unpatentable over Polaschegg in view of Behringer as applied to Claim 13, further in view of U.S. Patent No. 3,900,276 issued to Dilworth.

Claim 15 is rejected under 35 U.S.C. §103(a) as being unpatentable over Polaschegg as applied to Claim 6, in view of U.S. Patent No. 4,904,167 issued to Eickmann.

Applicant's pump is specifically designed for reduced stress and optimized movement of the membrane in order to provide improved accuracy, efficiency and life of the membrane. This leads to the combination of features claimed, which indeed provide improved performance over prior pumps.

New Claim 22 now requires that the cavity is elongate and the pressure port is offset towards one end of the pump cavity. This has several advantages which result in improved accuracy, efficiency and life of Applicant's pump.

The elongate shape of the cavity reduces stresses on the membrane when compared to a cavity with a generally square or circular shape. The elongate shape of the cavity is shown in Applicant's Figure 4, for example, where the width of the chamber is less than the length. In contrast, neither Behringer nor Polaschegg display any appreciation for the effects of the chamber shape on membrane stresses. The cavities in both Behringer and Polaschegg are presumably symmetrical, i.e. of equal width and length (generally square or circular when viewed in plan).

Furthermore, placing the pressure port towards one end of the cavity results in improved membrane motion, which reduces stress on the membrane and improves the accuracy of the pump. While to a person having ordinary skill in the art the natural position for the pressure port would be the center of the cavity (and indeed this is the position adopted by both Behringer and Polaschegg), Applicant has found that offsetting the pressure port results in improved performance. The asymmetrical position of the pressure port tends to cause asymmetrical motion of the membrane from one stable state to the other, which minimizes the resistance to this motion from within the membrane itself.

In contrast, the membrane of Polaschegg would exhibit much greater resistance to motion than Applicant's membrane. This would require higher pressure to drive motion of the membrane and result in higher stress on the membrane than in Applicant's device. Polaschegg's pump would therefore have a shorter membrane life and be less efficient than Applicant's pump.

These undesirable effects can be partially addressed using Applicant's elongate cavity with the pressure port offset towards one end of the cavity. Applicant's cavity therefore

contributes to the long life, accuracy and efficiency of the pump. Furthermore, the excellent efficiency and accuracy of Applicant's pump are substantially retained over the life of the pump due to the low stress placed on the membrane. In fact, for many applications, Applicant's membrane is no longer regarded as a part requiring maintenance or replacement. That is the membrane lasts for the life of the device. This is in complete contrast to prior membrane pumps where the membrane needs to be regularly replaced.

Polaschegg uses a symmetrical (i.e. non-elongate) chamber with the pressure port centrally located. There is no appreciation of the problems solved by Applicant's cavity shape and position of the pressure port. Nor is there any disclosure of those features of Applicant's claim.

The Examiner rejected Claim 15, now cancelled but retaining its limitations as part of new Claim 22 (which required the elongate cavity with offset pressure port) based on the combination of Polaschegg and Eickmann. The Examiner objects that the pressure port in Eickmann is offset and it would be obvious to combine this configuration with that of Polaschegg to arrive at the claimed invention.

Eickmann is a very different pump than Applicant's device. Eickmann is a pump operating at very high pressures (up to several thousand atmospheres). This places very high stresses on the membrane (column 5 lines 8 to 24). Eickmann therefore concludes that the membrane should be formed using spring steel or another strong metal (column 5 lines 21 to 24). Weakness in the structure of such steel membranes leads Eickmann to the multi-piece "membrane" of Figure 4, where an outer ring plate "with an outer radius "R" and inner radius "r" (column 5 lines 27 to 29) and an inner "body" 1523.

Furthermore, Eickmann does not disclose an elongate chamber. Eickmann's chamber is shown only in cross-section in the figures. However, note that Eickmann's "membrane" has a radius, so the membrane and the chamber are therefore explicitly circular, not elongate as required by Applicant's claims. There is no appreciation of the advantages of an elongate chamber, nor of the positioning of a pressure port within an elongate chamber.

Eickmann is also concerned with a membrane having a neutral central position, not with a pump such as Applicant's where a membrane having two stable states is in contact with the opposing surfaces of the cavity.

The high pressures and the metal materials used for the membrane lead to a wholly different set of design considerations than employed in a device such as Polaschegg. Polaschegg operates at pressures around atmospheric pressure (see column 3 line 5, column 3 line 13). The membrane is formed from a flexible rubber or polymer material (column 4 lines 37 to 40). Furthermore, if Polaschegg's membrane is, as held by the Examiner, one which bears without extension on the surfaces of the cavity, Eickmann's metal membrane would be wholly unsuitable. Therefore, one skilled in the art would not combine Eickmann and Polaschegg.

Furthermore, even if Eickmann and Polaschegg were combined, there would still be no disclosure of an elongate pump cavity. There would also be no disclosure of an elongate cavity with the pressure port offset towards one end of the cavity, as required by Claim 22. Furthermore, there is no realization in either Eickmann or Polaschegg of the problems solved by Applicant's device or the marked advantages of Applicant's configuration.

New independent Claim 22 is therefore both novel and inventive over the prior art.

Claims 3-5, 7, 9-14, 16, 17 and 20 depend from Claim 7 and further patentably distinct limitations thereto.

New independent Claim 23 requires that recessed flow paths are formed in the opposing surfaces of the cavity. Basis for this feature is found at page 7 lines 9 to 16 of the PCT specification. This passage discusses a 'narrow groove' formed in each surface. This narrow groove is also shown in the drawings.

This feature allows fluid to flow along each surface, even when the membrane is close to, or even in contact with, that surface. This helps to ensure that the cavity can be fully filled or evacuated, i.e. that the membrane can move fully and reliably into each of the stable states. Without such a recessed flow path, pockets of fluid can become trapped behind the membrane. This prevents the membrane from moving fully into the stable state in contact with the opposing surface. This prevents the membrane from moving as designed,

again reducing the pump volume in an uncontrolled and unpredictable manner. As discussed above, this reduced volume results both in reduced accuracy in the pump volume and reduced pump efficiency.

In addition, Applicant submits that the recessed flow path on the pressure port side of the pump cavity contributes to efficient flow of fluid into that side of the cavity from the pressure port, again contributing to overall efficiency and accuracy of the pump operation.

The prior art does not disclose such recessed flow paths, nor does it give any indication of appreciation of the problems solved by the recessed flow paths.

New independent Claim 23 is therefore both novel and inventive over the prior art.

Accordingly, Applicant respectfully requests the rejection under 35 U.S.C. §103(a) be withdrawn.

Therefore, Applicant believes that all pending claims are now patentable over the cited references.

CONCLUSION

Accordingly, from the amendments and remarks, Applicant believes that all of the pending claims, namely Claims 3-5, 7, 9-14, 16, 17, 20 and 22-28 are now in condition for allowance, which early action is requested.

If necessary, the Commissioner is hereby authorized in this, concurrent and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2666 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17, particularly, extension of time fees.

If a telephone interview would expedite the prosecution of this Application, the Examiner is invited to contact the undersigned at (310) 207-3800.

Respectfully submitted,

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I hereby certify that this correspondence is being submitted electronically via EFS Web on the date shown below

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Marilyn Bass October 26 2009